



US 20200303810A1

(19) **United States**(12) **Patent Application Publication**
TSAI et al.(10) **Pub. No.: US 2020/0303810 A1**(43) **Pub. Date: Sep. 24, 2020**(54) **MOBILE DEVICE AND MANUFACTURING METHOD THEREOF**(71) Applicant: **HTC Corporation**, Taoyuan City (TW)(72) Inventors: **Tiao-Hsing TSAI**, Taoyuan City (TW);
Chien-Pin CHIU, Taoyuan City (TW);
Hsiao-Wei WU, Taoyuan City (TW);
Shen-Fu TZENG, Taoyuan City (TW);
Yi-Hsiang KUNG, Taoyuan City (TW);
Li-Yuan FANG, Taoyuan City (TW)(73) Assignee: **HTC Corporation**, Taoyuan City (TW)(21) Appl. No.: **16/895,028**(22) Filed: **Jun. 8, 2020****Related U.S. Application Data**

(63) Continuation of application No. 15/723,336, filed on Oct. 3, 2017, now Pat. No. 10,727,569.

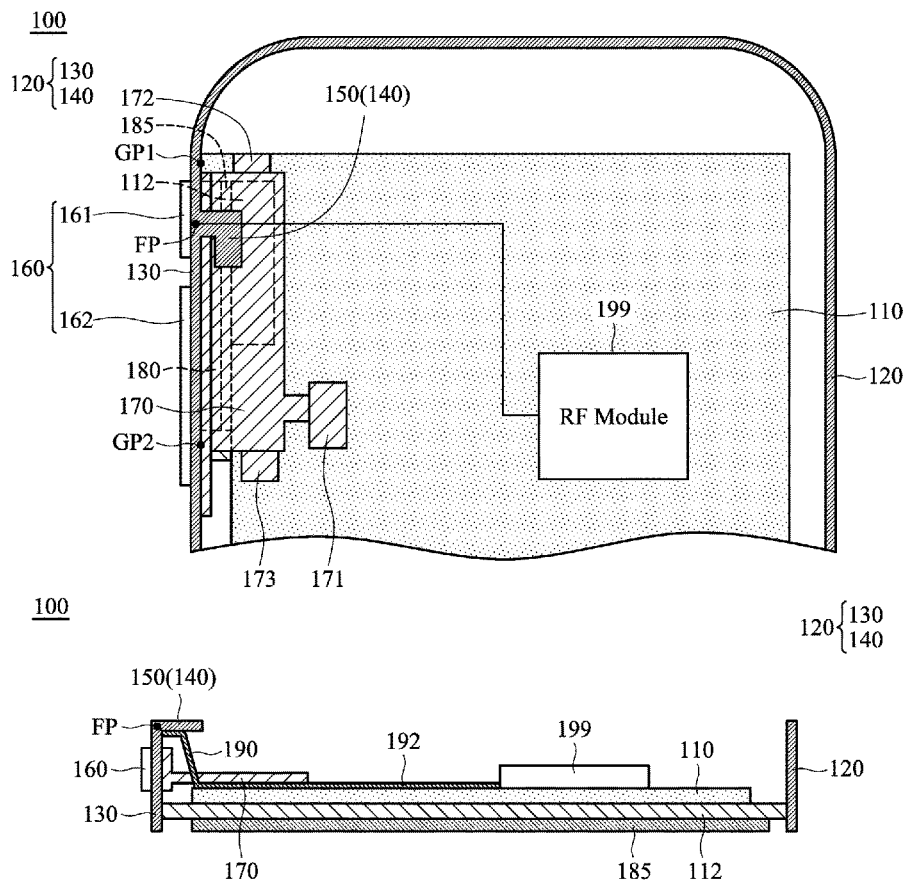
(60) Provisional application No. 62/437,226, filed on Dec. 21, 2016.

Publication Classification(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H04B 1/3827 (2006.01)**H01Q 1/48** (2006.01)**H01Q 9/04** (2006.01)**H01Q 1/38** (2006.01)**H01Q 5/35** (2006.01)**H04M 1/02** (2006.01)**H01Q 7/00** (2006.01)**H01Q 5/364** (2006.01)(52) **U.S. Cl.**CPC **H01Q 1/243** (2013.01); **H04B 1/3827**(2013.01); **H01Q 1/48** (2013.01); **H01Q****9/0421** (2013.01); **H04M 1/0283** (2013.01);**H01Q 5/35** (2015.01); **H04M 1/0277**(2013.01); **H01Q 7/005** (2013.01); **H01Q****5/364** (2015.01); **H01Q 1/38** (2013.01)

(57)

ABSTRACT

A mobile device at least includes a first circuit board, a metal frame, an electronic component, a second circuit board, and an RF (Radio Frequency) module. The first circuit board includes a system ground plane. The metal frame at least includes a first portion. The first portion is electrically coupled to the system ground plane and a feeding point. An antenna structure is formed by the first portion and the feeding point. The second circuit board is electrically coupled to the electronic component. The electronic component and the second circuit board are adjacent to the first portion of the metal frame. The RF module is electrically coupled to the feeding point, so as to excite the antenna structure.





US 20200303818A1

(19) **United States**(12) **Patent Application Publication**
Friman(10) **Pub. No.: US 2020/0303818 A1**(43) **Pub. Date: Sep. 24, 2020**(54) **WIDEBAND ANTENNA**(71) Applicant: **SHORTLINK RESOURCES AB,**
Karlstad (SE)(72) Inventor: **Alf Friman, Karlstad (SE)**(21) Appl. No.: **16/651,601**(22) PCT Filed: **Sep. 28, 2018**(86) PCT No.: **PCT/SE2018/050997**

§ 371 (c)(1),

(2) Date: **Mar. 27, 2020**(30) **Foreign Application Priority Data**

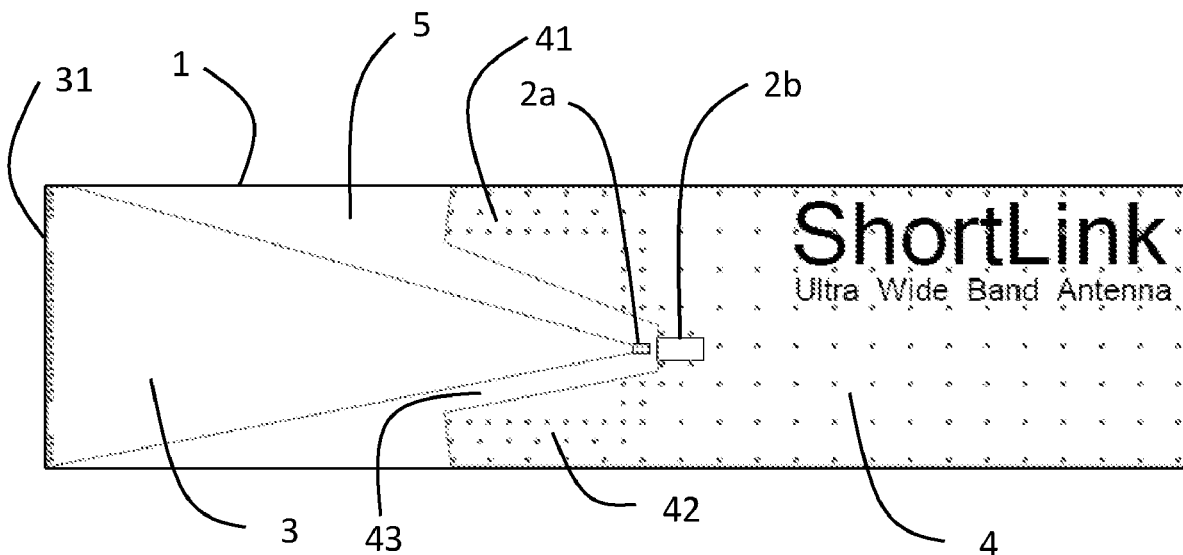
Sep. 28, 2017 (SE) 1751201-3

Publication Classification(51) **Int. Cl.****H01Q 5/25** (2006.01)**H01Q 5/364** (2006.01)**H01Q 1/48** (2006.01)(52) **U.S. Cl.**CPC **H01Q 5/25** (2015.01); **H01Q 1/48**
(2013.01); **H01Q 5/364** (2015.01)

(57)

ABSTRACT

A wideband/broadband antenna is described, comprising a dielectric substrate with a first surface with an antenna feed with two conductors, comprising a first feed connection and a second feed connection, wherein the second feed connection is or acts as the ground. A first conductive layer extends from the antenna feed in a first direction and is electrically connected to the first feed connection, wherein the first conductive layer extends in a direction away from the antenna feed, and to a first end edge. A second conductive layer extends in a second direction, away from the first conductive layer, and is electrically connected to the second feed connection. A non-conductive zone separates the first and second conductive layers. On a second surface of the substrate there is a third conductive layer which extends from a second end edge in the direction towards the antenna feed, the extent of which at least in part coincides with that of the first conducting layer at the first surface. The first end edge of the first conducting layer and the second end edge of the third conducting layer substantially coincides, and the first and third electrical layers are electrically connected with each other at or near said end edges. Apart from said electrical interconnection at the edges, the layers are electrically separated from each other.





US 20200303840A1

(19) **United States**(12) **Patent Application Publication**
Singh(10) **Pub. No.: US 2020/0303840 A1**(43) **Pub. Date: Sep. 24, 2020**(54) **MULTI-MODE ANTENNA SYSTEM**(71) Applicant: **AVX Antenna, Inc. d/b/a Ethertronics, Inc.**, San Diego, CA (US)(72) Inventor: **Abhishek Singh**, San Diego, CA (US)(21) Appl. No.: **16/820,864**(22) Filed: **Mar. 17, 2020****Related U.S. Application Data**

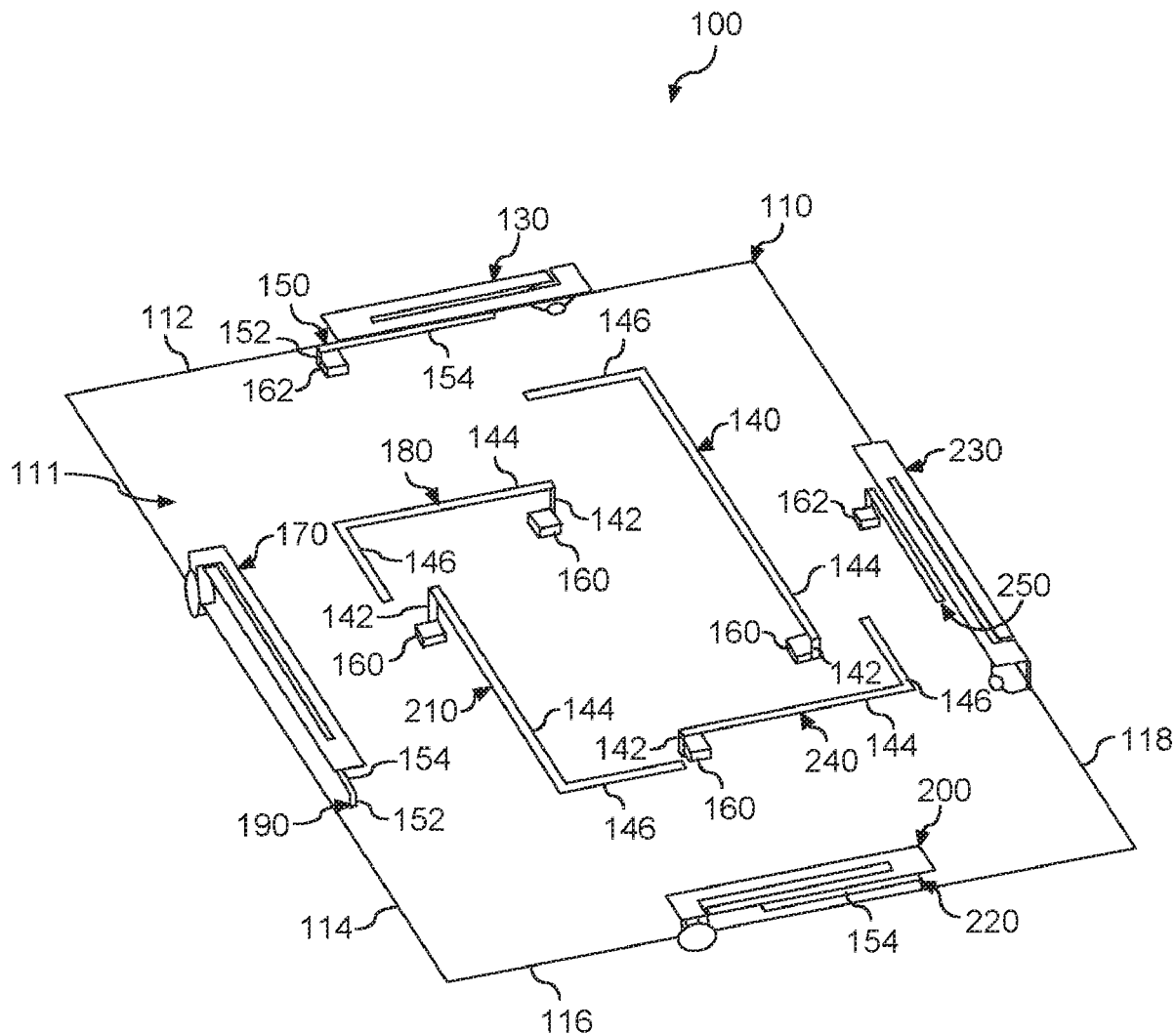
(60) Provisional application No. 62/821,740, filed on Mar. 21, 2019.

Publication Classification(51) **Int. Cl.****H01Q 25/04** (2006.01)**H01Q 1/48** (2006.01)**H01Q 9/16** (2006.01)(52) **U.S. Cl.**CPC **H01Q 25/04** (2013.01); **H01Q 9/16** (2013.01); **H01Q 1/48** (2013.01)

(57)

ABSTRACT

A multi-mode antenna system include at least a first modal antenna and a second modal antenna. The first modal antenna is disposed on a ground plane of a circuit board and configurable in a plurality of different modes. The first modal antenna can include a driven element, at least one parasitic element and an active element configured to adjust a reactance of the at least one parasitic element. The multi-mode antenna system further includes a second modal antenna disposed on the ground plane and configurable in a plurality of different modes. The second modal antenna can include a driven element, at least one parasitic element, and an active element configured to adjust a reactance of the at least one parasitic element. The parasitic element of the second modal antenna is positioned such that adjusting the reactance of the parasitic element affects the radiation pattern associated with the first modal antenna.





US 20200310495A1

(19) **United States**(12) **Patent Application Publication****Kuna et al.**(10) **Pub. No.: US 2020/0310495 A1**(43) **Pub. Date: Oct. 1, 2020**(54) **ELECTRONIC DEVICE HOUSING WITH INTEGRATED ANTENNA****Publication Classification**(71) Applicant: **Apple Inc.**, Cupertino, CA (US)(72) Inventors: **Melody L. Kuna**, Palo Alto (CA);
Carlo Catalano, Capitola, CA (US);
Lee B. Hamstra, Mountain View, CA (US);
Ross Errett, Cupertino, CA (US);
Devin Williams, Cupertino, CA (US);
Florence W. Ow, Los Altos Hills, CA (US);
Alex Chung Lap Yeung, San Francisco, CA (US);
Carli Oster, San Francisco, CA (US)(51) **Int. Cl.****G06F 1/16** (2006.01)**H01Q 1/22** (2006.01)**G06F 3/044** (2006.01)**H01Q 1/24** (2006.01)(52) **U.S. Cl.**CPC **G06F 1/1656** (2013.01); **H01Q 1/2258**
(2013.01); **H01Q 1/243** (2013.01); **G06F**
1/1626 (2013.01); **G06F 3/044** (2013.01)

(57)

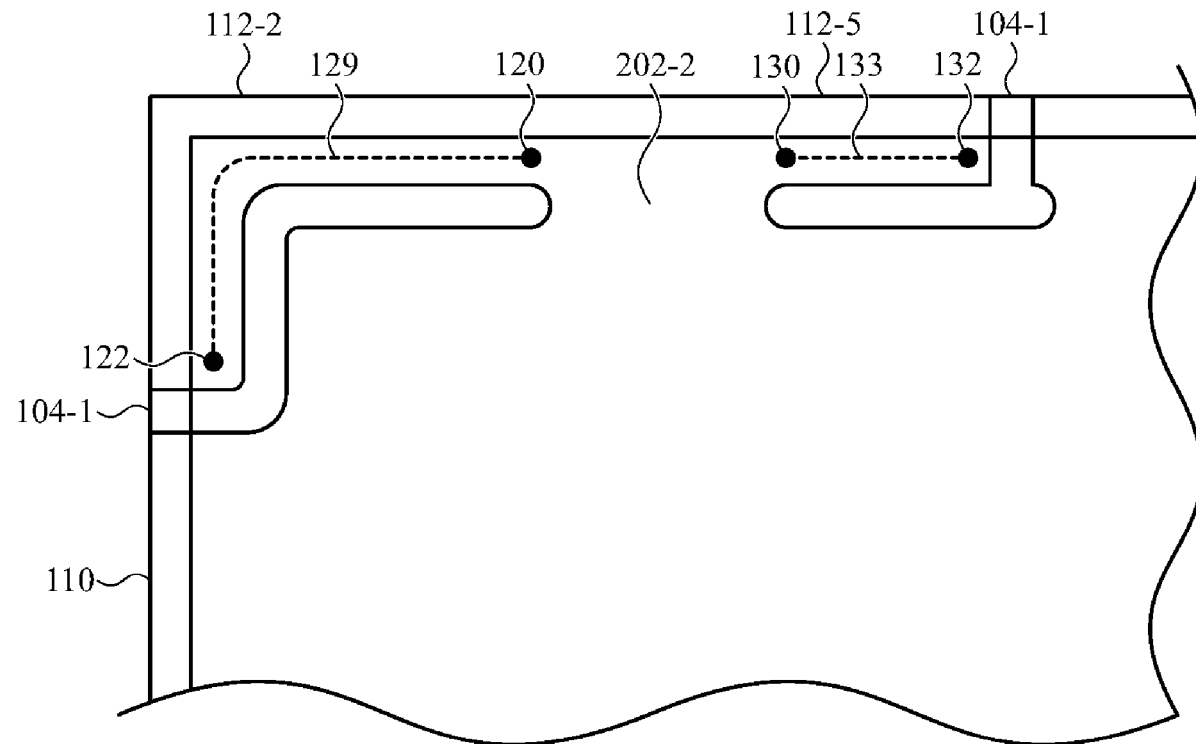
ABSTRACT

An electronic device may include a display, a housing member at least partially surrounding the display and including a first segment defining a first portion of an exterior surface of the electronic device, a second segment defining a second portion of the exterior surface of the electronic device and configured to function as an antenna, and a bridge segment structurally and conductively coupling the first segment to the second segment. The electronic device may also include a molded element positioned between the first segment and the second segment and defining a third portion of the exterior surface of the electronic device.

(21) Appl. No.: **16/903,110**(22) Filed: **Jun. 16, 2020****Related U.S. Application Data**

(63) Continuation of application No. 16/183,591, filed on Nov. 7, 2018, now Pat. No. 10,705,570.

(60) Provisional application No. 62/725,227, filed on Aug. 30, 2018.





US 20200312798A1

(19) **United States**(12) **Patent Application Publication**
KAWAHATA(10) **Pub. No.: US 2020/0312798 A1**(43) **Pub. Date: Oct. 1, 2020**(54) **ANTENNA APPARATUS, ANTENNA
MODULE, AND WIRELESS APPARATUS****Publication Classification**(71) Applicant: **Murata Manufacturing Co., Ltd.,**
Kyoto (JP)(72) Inventor: **Kazunari KAWAHATA**, Kyoto (JP)(21) Appl. No.: **16/899,873**(22) Filed: **Jun. 12, 2020****Related U.S. Application Data**(63) Continuation of application No. PCT/JP2018/
044369, filed on Dec. 3, 2018.(30) **Foreign Application Priority Data**

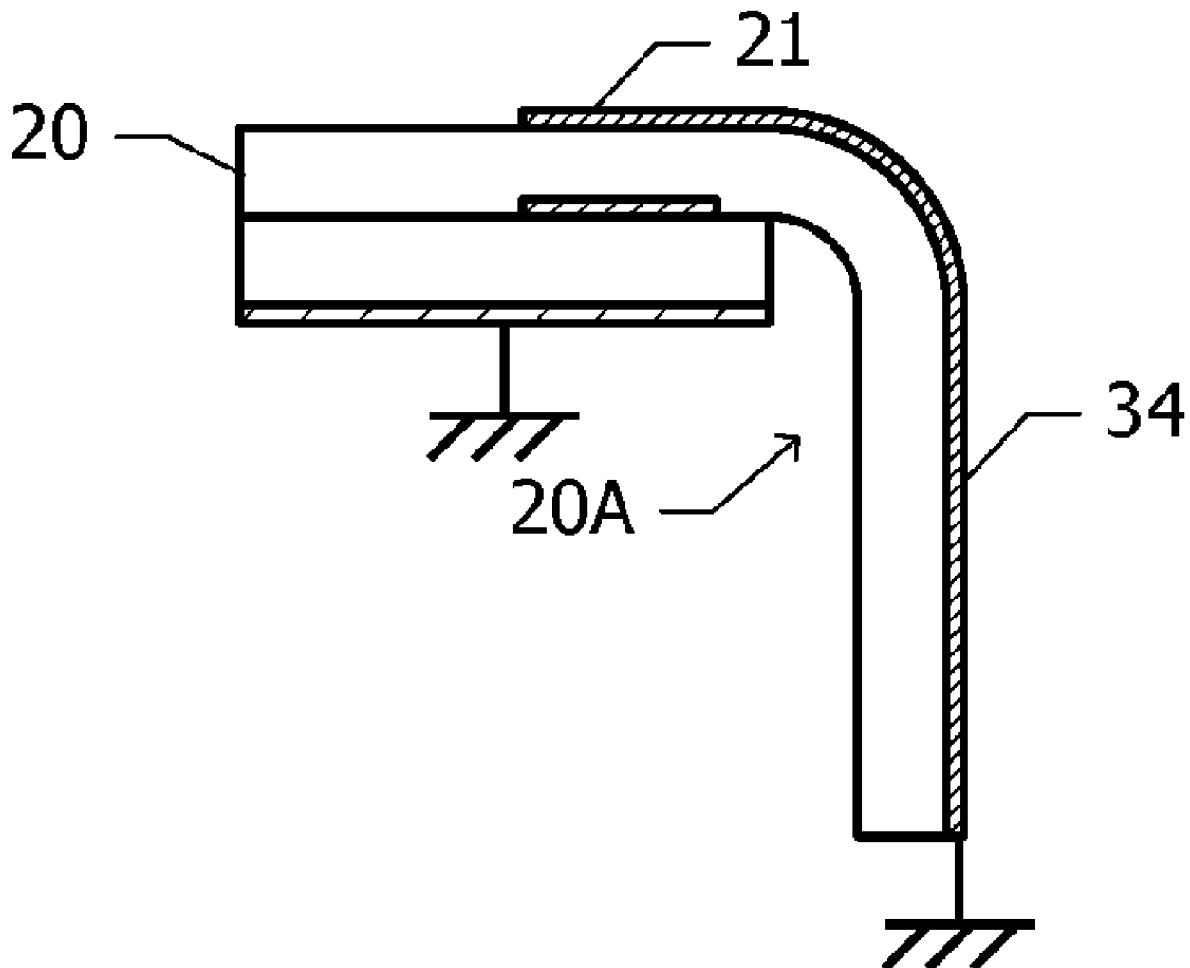
Dec. 14, 2017 (JP) 2017-239239

(51) **Int. Cl.****H01L 23/66** (2006.01)**H01Q 1/48** (2006.01)**H01Q 9/04** (2006.01)**G01S 7/03** (2006.01)(52) **U.S. Cl.**CPC **H01L 23/66** (2013.01); **H01Q 1/48**(2013.01); **H01L 2223/6627** (2013.01); **G01S****7/032** (2013.01); **H01L 2223/6677** (2013.01);**H01Q 9/0407** (2013.01)

(57)

ABSTRACT

A feeding element is disposed on or in a first substrate. A second substrate overlies the feeding element. The second substrate is a flexible substrate including an extending portion extending outside the first substrate. A parasitic element coupled to the feeding element is disposed on or in the second substrate. A radiating electrode connected to the parasitic element is disposed on the extending portion of the second substrate.





US 20200313272A1

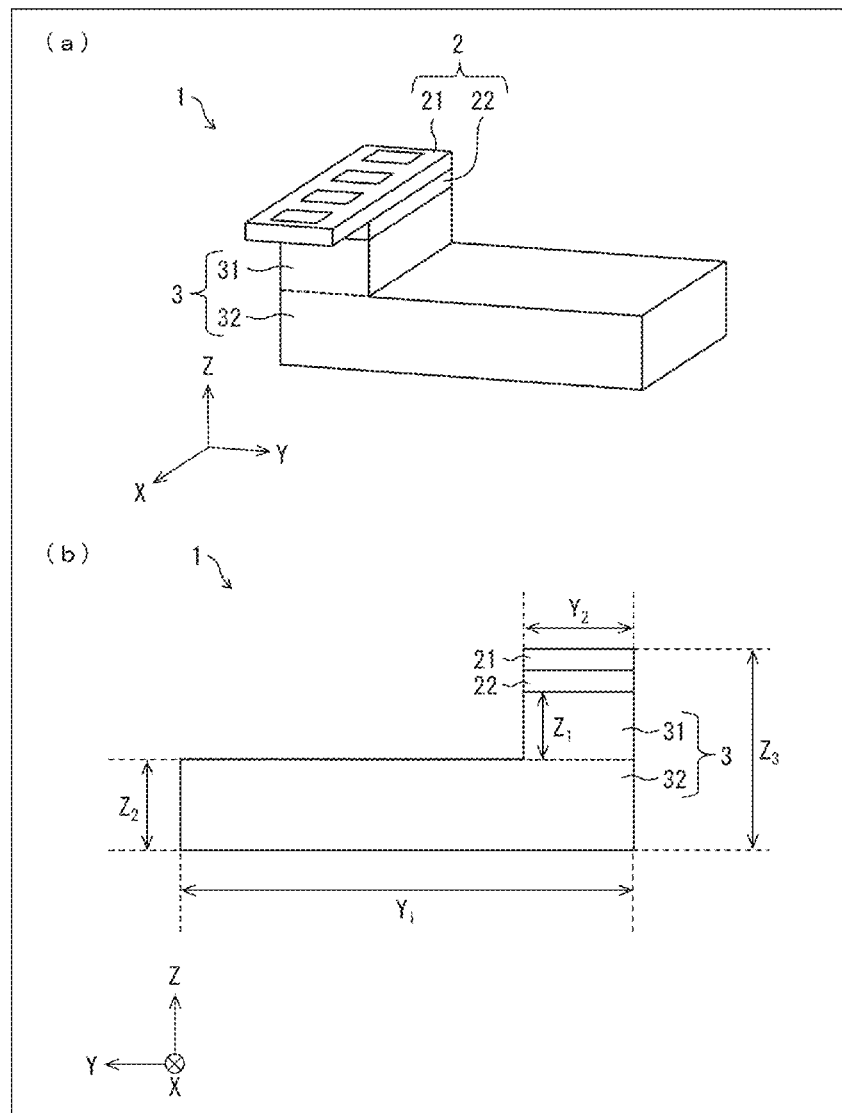
(19) **United States**(12) **Patent Application Publication** (10) **Pub. No.: US 2020/0313272 A1**
(43) **Pub. Date:** **Oct. 1, 2020**(54) **ANTENNA APPARATUS AND
COMMUNICATIONS TERMINAL
APPARATUS**(52) **U.S. Cl.**
CPC **H01Q 1/02** (2013.01); **H04B 1/036**
(2013.01)(71) Applicant: **SHARP KABUSHIKI KAISHA**, Sakai
City (JP)(57) **ABSTRACT**(72) Inventor: **NAOKI SOTOMA**, Sakai City (JP)(21) Appl. No.: **16/821,707**(22) Filed: **Mar. 17, 2020**(30) **Foreign Application Priority Data**

Mar. 26, 2019 (JP) 2019-058999

Publication Classification(51) **Int. Cl.**
H01Q 1/02 (2006.01)
H04B 1/036 (2006.01)

An antenna apparatus includes: an antenna substrate including a heat source provided to at least one face of the antenna substrate; and a heat dissipator configured to dissipate heat produced in the heat source. The heat dissipator contacts with at least a portion of the heat source.

An area of a cross section parallel to the antenna substrate of the heat dissipator at a distance less than a predetermined distance in a normal direction of the contact face from the contact face is equal to or less than an area of the contact face, and an area of a cross section parallel to the antenna substrate of the heat dissipator at a distance equal to or more than the predetermined distance from the contact face is larger than the area of the contact face.





US 20200313277A1

(19) **United States**(12) **Patent Application Publication**
TOMO et al.(10) **Pub. No.: US 2020/0313277 A1**(43) **Pub. Date: Oct. 1, 2020**(54) **ULTRA-WIDEBAND ANTENNA****Publication Classification**(71) Applicant: **NETEERA TECHNOLOGIES LTD.**,
Jerusalem (IL)(72) Inventors: **Uzi TOMO**, Jerusalem (IL); **Haim**
GOLDBERGER, Modin (IL)(21) Appl. No.: **16/310,832**(22) PCT Filed: **May 22, 2018**(86) PCT No.: **PCT/IL2018/050555**

§ 371 (c)(1),

(2) Date: **Dec. 18, 2018**(51) **Int. Cl.****H01Q 1/22** (2006.01)**H01Q 21/06** (2006.01)**H01Q 9/28** (2006.01)(52) **U.S. Cl.**CPC **H01Q 1/2283** (2013.01); **H01Q 9/285**
(2013.01); **H01Q 21/062** (2013.01)

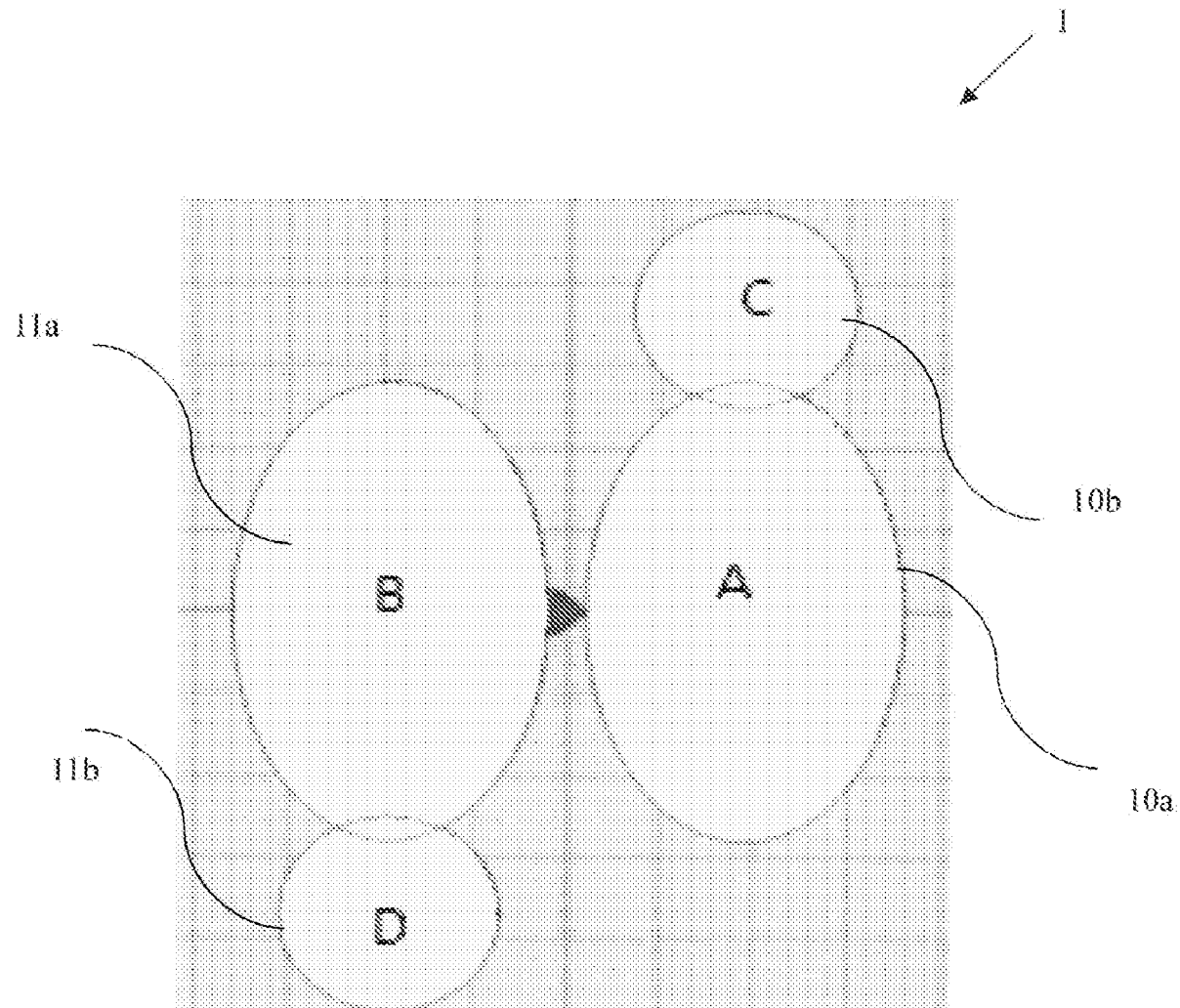
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ABSTRACT

An antenna pattern integrated-on-chip for transmitting and/or receiving sub-terahertz and terahertz (THZ) signal& The antenna pattern comprising: a first conductor having a bi-circular structure a second conductor having a bi-circular structure connected to the first bi-circular structure. The bi-circular structures comprising a first conductive circular lobe having a radius (Rx) and a second circular lobe having a radius (Rc), such that said $R_x \geq R_c$. The first bi-circular and the second bi-circular characterized by at least one port thereby, having an area of intersection between the first bi-circular and the second lei-circular, forming an ultra-wideband (UWB) frequency response of more than about 100% bandwidth.

Related U.S. Application Data

(60) Provisional application No. 62/510,788, filed on May 25, 2017.





US 20200313282A1

(19) **United States**

(12) **Patent Application Publication**
Jia

(10) **Pub. No.: US 2020/0313282 A1**

(43) **Pub. Date: Oct. 1, 2020**

(54) **ANTENNA MODULE AND ELECTRONIC DEVICE**

(71) Applicant: **GUANGDONG OPPO MOBILE TELECOMMUNICATIONS CORP., LTD.**, Dongguan (CN)

(72) Inventor: **Yuhu Jia**, Dongguan (CN)

(21) Appl. No.: **16/816,875**

(22) Filed: **Mar. 12, 2020**

(30) **Foreign Application Priority Data**

Mar. 28, 2019 (CN) 201910244229.2

Publication Classification

(51) **Int. Cl.**

<i>H01Q 1/24</i>	(2006.01)
<i>H01Q 1/48</i>	(2006.01)
<i>H01Q 9/04</i>	(2006.01)
<i>H01Q 13/10</i>	(2006.01)
<i>H01Q 5/307</i>	(2006.01)

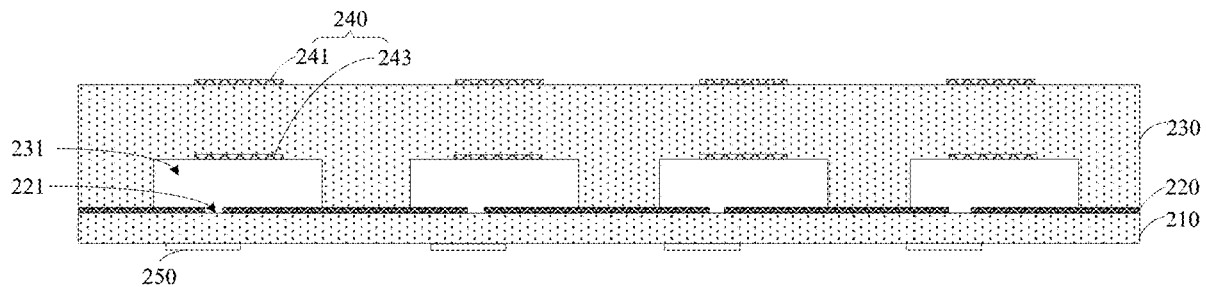
(52) **U.S. Cl.**

CPC *H01Q 1/243* (2013.01); *H01Q 1/48* (2013.01); *H01Q 5/307* (2015.01); *H01Q 13/10* (2013.01); *H01Q 9/0464* (2013.01); *H01Q 9/0414* (2013.01)

(57)

ABSTRACT

The present disclosure relates to an antenna module and an electronic device. The antenna module includes: a first dielectric layer; a ground layer arranged on the first dielectric layer, and provided with at least one slot; a second dielectric layer arranged on the ground layer, and provided with an air chamber communicated with the at least one slot; a stacked patch antenna including a first radiation patch and a second radiation patch, the first radiation patch being attached to a side of the second dielectric layer facing away from the ground layer, and the second radiation patch being attached to a side of the second dielectric layer provided with the air chamber; and a feeding unit arranged to a side of the first dielectric layer facing away from the ground layer, and configured to feed the stacked patch antenna by the at least one slot.





US 20200313295A1

(19) **United States**(12) **Patent Application Publication**
ADELA et al.(10) **Pub. No.: US 2020/0313295 A1**(43) **Pub. Date: Oct. 1, 2020**(54) **DUAL-BAND DIRECTIONAL ANTENNA,
WIRELESS DEVICE, AND WIRELESS
COMMUNICATION SYSTEM****Publication Classification**(51) **Int. Cl.****H01Q 5/30** (2006.01)**H01Q 1/24** (2006.01)**H01Q 21/24** (2006.01)(52) **U.S. Cl.**CPC **H01Q 5/30** (2015.01); **H01Q 21/24**
(2013.01); **H01Q 1/246** (2013.01)(71) Applicant: **THE ANTENNA COMPANY
INTERNATIONAL N.V.**, Willemstad
(CW)(72) Inventors: **Bedilu Befekadu ADELA**, Eindhoven
(NL); **Daniel Alexandru CRINGUS**,
Veldhoven (NL); **Diego CARATELLI**,
Eersel (NL)

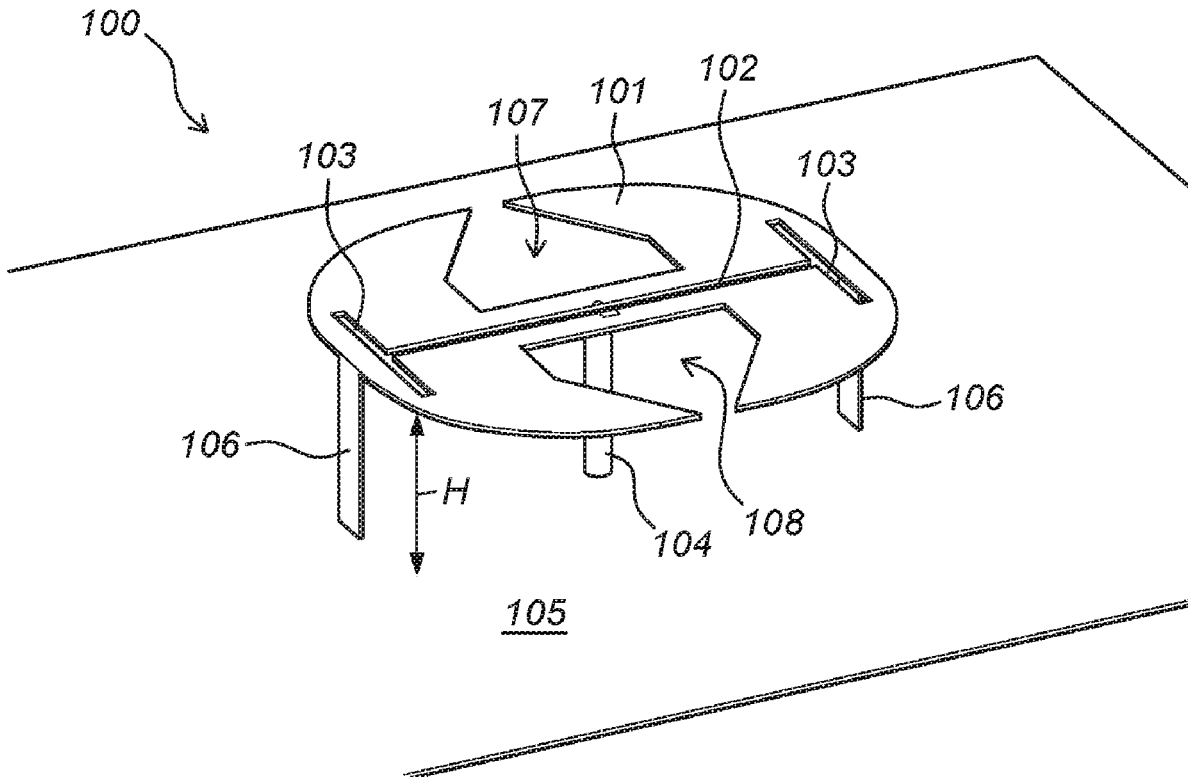
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ABSTRACT

The invention relates to a dual-band directional antenna, in particular for customer-premise equipment (CPE) applications. The invention also relates to a wireless device for customer-premise equipment (CPE) applications, such as a wireless access points (AP), a router, a gateway, and/or a bridge, comprising at least one antenna according to the invention. The invention additionally relates to a wireless communication system, comprising a plurality of antennas according to the invention, and, preferably, a plurality of wireless devices according to the invention.

(21) Appl. No.: **16/831,002**(22) Filed: **Mar. 26, 2020**(30) **Foreign Application Priority Data**

Mar. 27, 2019 (NL) 2022823





US 20200313299A1

(19) **United States**(12) **Patent Application Publication**
Jia(10) **Pub. No.: US 2020/0313299 A1**(43) **Pub. Date: Oct. 1, 2020**(54) **ANTENNA MODULE AND ELECTRONIC
DEVICE****H01Q 5/307** (2006.01)**H01Q 13/10** (2006.01)(71) Applicant: **GUANGDONG OPPO MOBILE
TELECOMMUNICATIONS CORP.,
LTD.**, Dongguan (CN)(52) **U.S. Cl.**CPC **H01Q 9/0414** (2013.01); **H01Q 1/48**
(2013.01); **H01Q 13/10** (2013.01); **H01Q**
5/307 (2015.01); **H01Q 9/045** (2013.01)(72) Inventor: **Yuhu Jia**, Dongguan (CN)

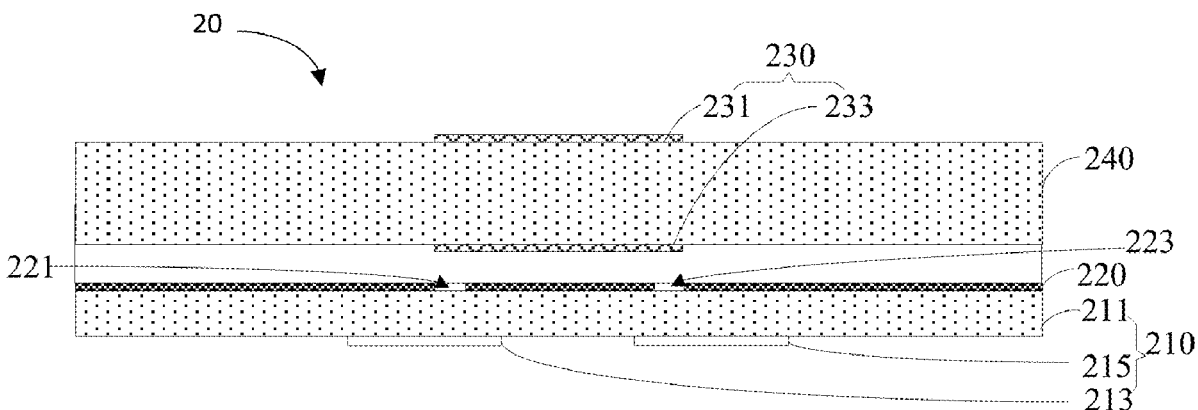
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ABSTRACT

The present disclosure relates to an antenna module and an electronic device. The antenna module includes: a feeding layer; a ground layer arranged on the feeding layer and provided with a first slot and a second slot, the first slot and the second slot being separated and having orthogonal polarization directions; a dielectric base plate arranged on the ground layer; and a stacked patch antenna including a first radiation patch and a second radiation patch. The first radiation patch and the second radiation patch are arranged on two sides of the dielectric base plate facing away from each other, respectively, and the first radiation patch is aligned with the second radiation patch. The feeding layer is configured to feed the stacked patch antenna through the first slot and the second slot.

(21) Appl. No.: **16/816,884**(22) Filed: **Mar. 12, 2020**(30) **Foreign Application Priority Data**

Mar. 28, 2019 (CN) 201910243151.2

Publication Classification(51) **Int. Cl.****H01Q 9/04** (2006.01)**H01Q 1/48** (2006.01)



US 20200313302A1

(19) **United States**(12) **Patent Application Publication**
MA et al.(10) **Pub. No.: US 2020/0313302 A1**(43) **Pub. Date: Oct. 1, 2020**(54) **LOW PROFILE WIDEBAND ANTENNA****H01Q 9/42** (2006.01)**H01Q 13/16** (2006.01)(71) Applicant: **AGENCY FOR SCIENCE,
TECHNOLOGY AND RESEARCH,**
Singapore (SG)(52) **U.S. Cl.**CPC **H01Q 9/40** (2013.01); **H01Q 13/16**
(2013.01); **H01Q 9/42** (2013.01); **H01Q 1/48**
(2013.01)(72) Inventors: **Yugang MA**, Singapore (SG); **Pankaj
SHARMA**, Singapore (SE); **Ser Wah
OH**, Singapore (SG)(21) Appl. No.: **16/089,352**

(57)

ABSTRACT(22) PCT Filed: **Mar. 28, 2017**(86) PCT No.: **PCT/SG2017/050165**

§ 371 (c)(1),

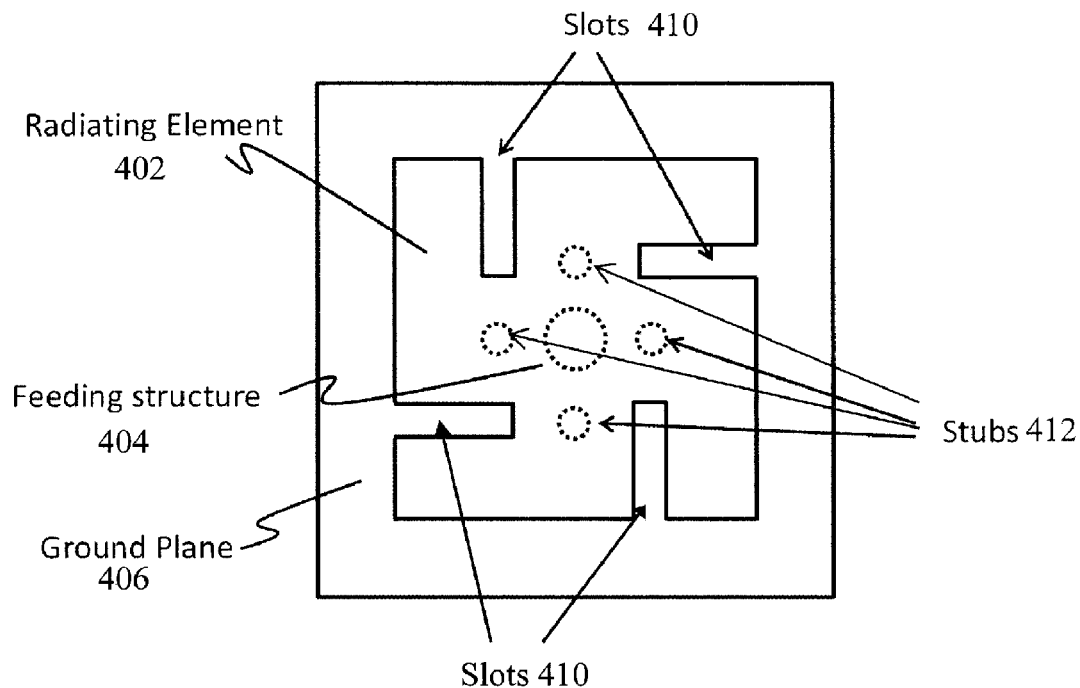
(2) Date: **Sep. 27, 2018**(30) **Foreign Application Priority Data**

Mar. 29, 2016 (SG) 10201602454V

Publication Classification(51) **Int. Cl.****H01Q 9/40** (2006.01)**H01Q 1/48** (2006.01)

A low-profile wideband monopole antenna is provided. The antenna may include a radiating element configured in a bent monopole arrangement to provide a vertical polarization such that an omni-directional radiating characteristic is achieved. The radiating element may include a plurality of slots formed at or edged from each side of the radiating element to increase the effective current path length of the radiating element. The antenna may include a feed and a feeding structure extending from the radiating element to the feed. The antenna may further include a ground plane. The radiating element may be arranged substantially parallel to the ground plane. The surface area of the radiating element may be smaller than the ground plane.

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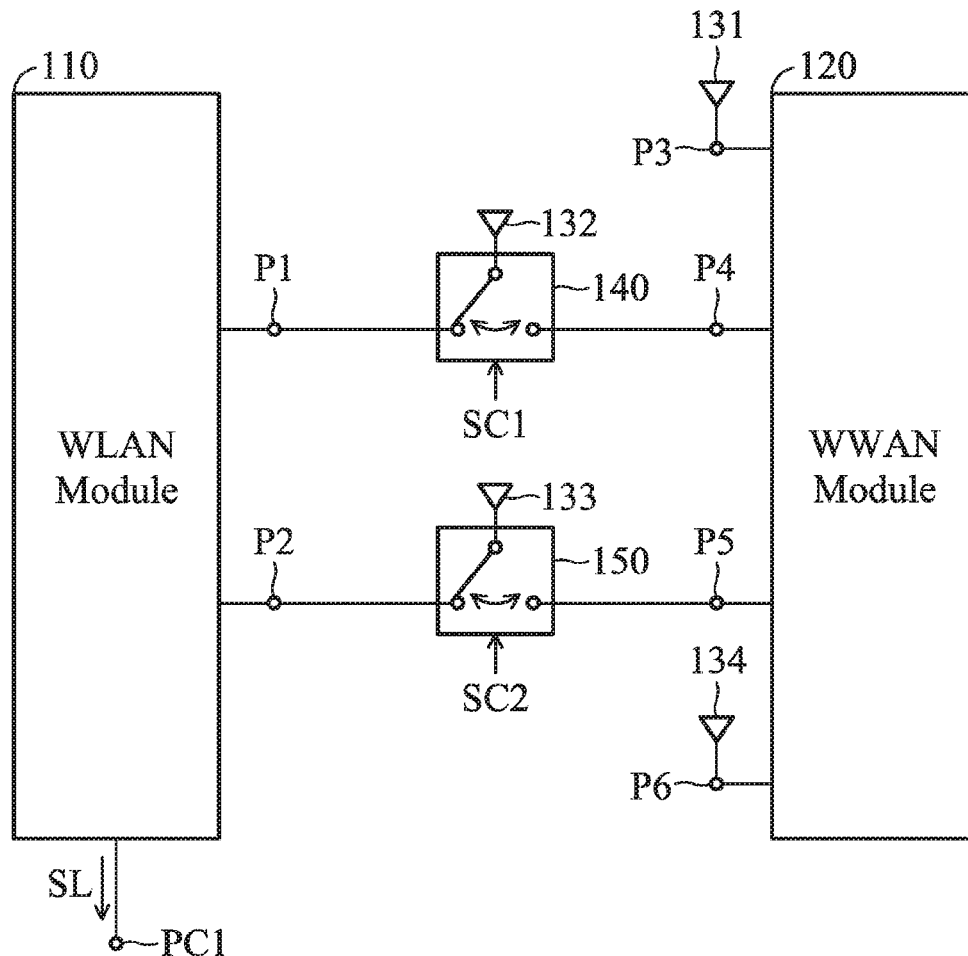
US 20200313308A1

(19) **United States**(12) **Patent Application Publication**
CHANG et al.(10) **Pub. No.: US 2020/0313308 A1**(43) **Pub. Date: Oct. 1, 2020**(54) **MOBILE DEVICE****H01Q 21/29** (2006.01)**H04B 7/0426** (2006.01)(71) Applicant: **Wistron Corp.**, New Taipei City (TW)(52) **U.S. Cl.**(72) Inventors: **Yu-Chia CHANG**, New Taipei City (TW); **Wan Chu WEI**, New Taipei City (TW); **Chun-Hong KUO**, New Taipei City (TW); **Tsung-Te LIN**, New Taipei City (TW)CPC **H01Q 21/28** (2013.01); **H04B 7/0426** (2013.01); **H01Q 21/29** (2013.01); **H01Q 1/50** (2013.01)(21) Appl. No.: **16/416,332**(22) Filed: **May 20, 2019**(30) **Foreign Application Priority Data**

Mar. 29, 2019 (TW) 108111140

Publication Classification(51) **Int. Cl.****H01Q 21/28** (2006.01)**H01Q 1/50** (2006.01)(57) **ABSTRACT**

A mobile device includes a WLAN (Wireless Local Area Network) module, a WWAN (Wireless Wide Area Network) module, a first antenna element, a second antenna element, a third antenna element, a fourth antenna element, a first switch element, and a second switch element. The WLAN module has a first port, a second port, and a first control port. The WWAN module has a third port, a fourth port, a fifth port, and a sixth port. The first antenna element is coupled to the third port. The first switch element couples the second antenna element to the first port or the fourth port according to a first control signal. The second switch element couples the third antenna element to the second port or the fifth port according to a second control signal. The fourth antenna element is coupled to the sixth port.

100



US 20200321688A1

(19) **United States**(12) **Patent Application Publication**
Khripkov et al.(10) **Pub. No.: US 2020/0321688 A1**(43) **Pub. Date: Oct. 8, 2020**(54) **ANTENNA SYSTEM FOR A WIRELESS COMMUNICATION DEVICE****Publication Classification**

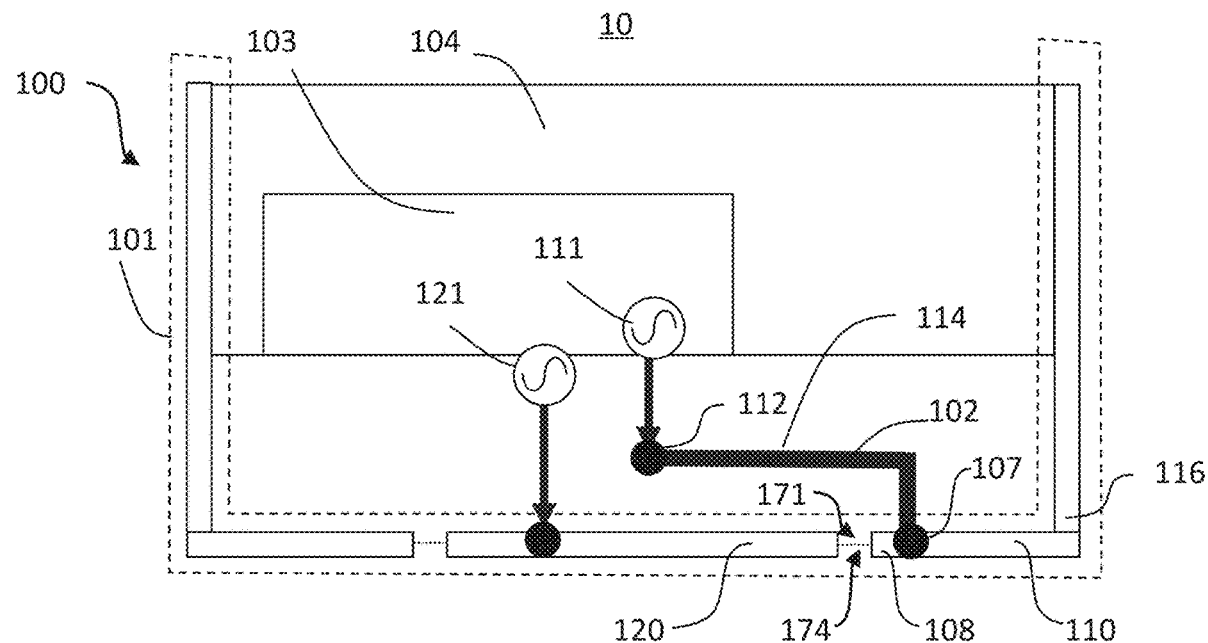
(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 5/35 (2006.01)
(52) **U.S. Cl.**
CPC *H01Q 1/243* (2013.01); *H01Q 5/35* (2015.01)

(71) Applicant: **Huawei Technologies Co., Ltd.,**
Shenzhen (CN)(72) Inventors: **Alexander Khripkov**, Helsinki (FI);
Joonas Krogerus, Helsinki (FI); **Arun Sowpati**, Helsinki (FI); **Zlatoljub Milosavljevic**, Helsinki (FI)(21) Appl. No.: **16/753,513**(22) PCT Filed: **Oct. 5, 2017**(86) PCT No.: **PCT/EP2017/075385**

§ 371 (c)(1),

(2) Date: **Apr. 3, 2020**(57) **ABSTRACT**

An antenna system for a mobile device includes a first electrically conductive member having a plurality of segments including at least a first corner segment and a central segment that is disposed adjacent to the first corner segment. A dielectric material is disposed in a gap between the first corner segment and the central segment. A second electrically conductive member is disposed within the mobile device. A first end of the second electrically conductive member is connected to the first corner segment. A portion of the second electrically conductive member away from the first end is electrically connected to a first feeding portion. The central segment is connected to a second feeding portion.





US 20200321696A1

(19) **United States**(12) **Patent Application Publication**
Chen et al.(10) **Pub. No.: US 2020/0321696 A1**(43) **Pub. Date: Oct. 8, 2020**(54) **ANTENNA DEVICE AND TERMINAL****H01Q 1/48** (2006.01)(71) Applicant: **JRD COMMUNICATION**
(SHENZHEN) LTD., Shenzhen (CN)(52) **U.S. Cl.****H01Q 1/22** (2006.01)CPC **H01Q 1/50** (2013.01); **H01Q 1/22**
(2013.01); **H01Q 1/48** (2013.01); **H01Q 1/36**
(2013.01)(72) Inventors: **Lei Chen**, Shenzhen (CN); **Liyun Liu**,
Shenzhen (CN)(21) Appl. No.: **16/910,064**(22) Filed: **Jun. 24, 2020**

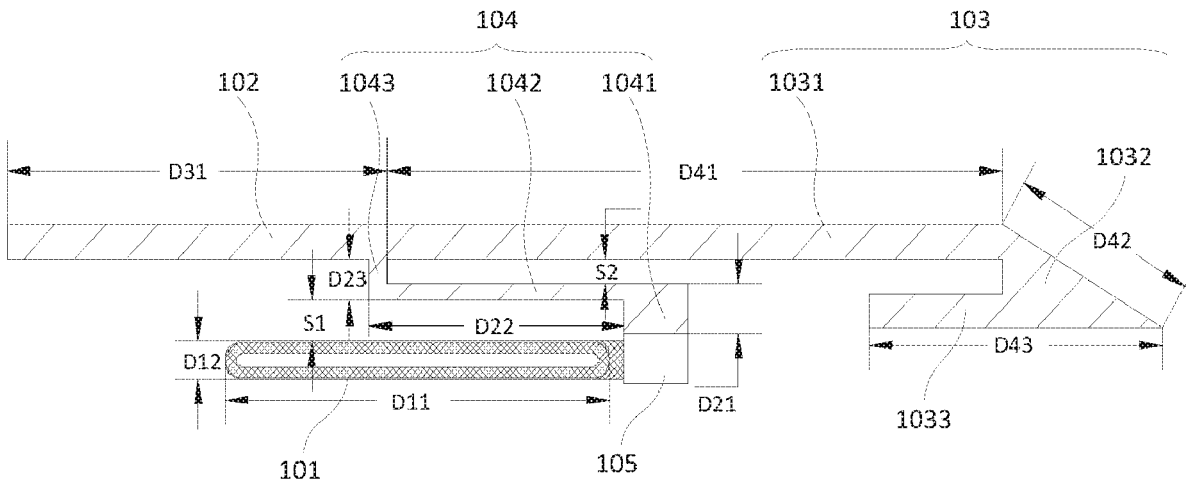
(57)

ABSTRACT**Related U.S. Application Data**(63) Continuation of application No. PCT/CN2018/
122878, filed on Dec. 21, 2018.(30) **Foreign Application Priority Data**

Dec. 25, 2017 (CN) 201711442262.3

Publication Classification(51) **Int. Cl.****H01Q 1/50** (2006.01)**H01Q 1/36** (2006.01)

The present disclosure discloses an antenna device and a terminal. The antenna device includes a first branch, a second branch, a third branch, a public branch, and a feed point. The first branch, the second branch, the third branch, a public branch and the feed point constitute a diversity antenna cooperatively. The first branch is configured as an earpiece metal mesh. The feed point is electrically connected to the first branch. The second branch and the third branch are electrically connected to an end of the public branch, respectively. An another end of the public branch is electrically connected to the feed point.



(19) **United States**(12) **Patent Application Publication**
JO et al.(10) **Pub. No.: US 2020/0321698 A1**(43) **Pub. Date: Oct. 8, 2020**(54) **FRONTEND MODULE***H03H 7/38* (2006.01)(71) Applicant: **SAMSUNG**
ELECTRO-MECHANICS CO., LTD.,
Suwon-si (KR)*H03H 7/01* (2006.01)*H04L 5/14* (2006.01)*H04W 84/12* (2006.01)(72) Inventors: **Kang Ta JO**, Suwon-si (KR); **Seong Jong CHEON**, Suwon-si (KR)(52) **U.S. Cl.**CPC *H01Q 5/307* (2015.01); *H03H 7/463*(2013.01); *H04W 84/12* (2013.01); *H03H**7/0115* (2013.01); *H04L 5/14* (2013.01);*H03H 7/38* (2013.01)(73) Assignee: **SAMSUNG**
ELECTRO-MECHANICS CO., LTD.,
Suwon-si (KR)(21) Appl. No.: **16/670,636**

(57)

ABSTRACT(22) Filed: **Oct. 31, 2019**(30) **Foreign Application Priority Data**

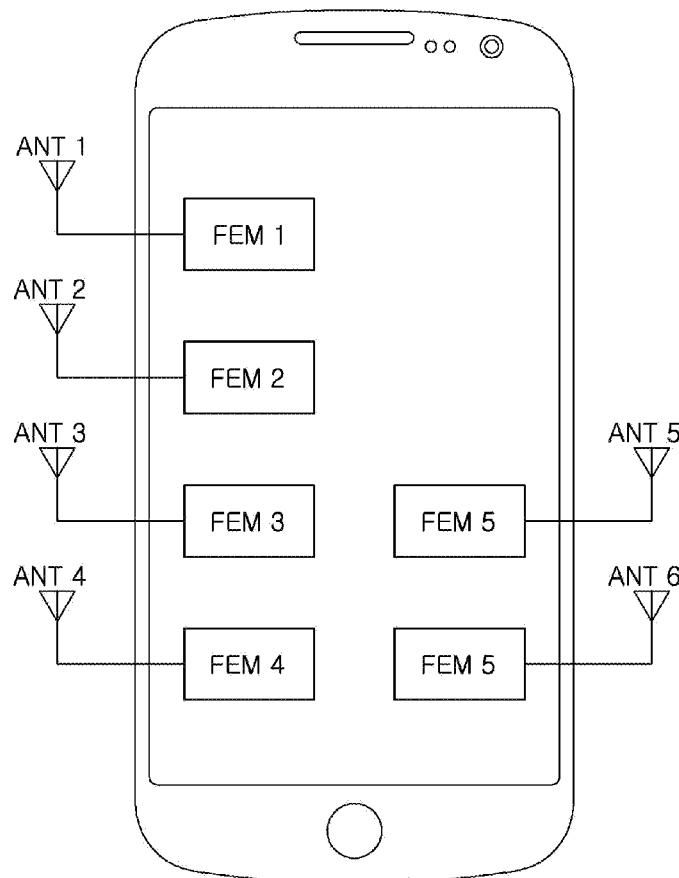
Apr. 5, 2019 (KR) 10-2019-0039982

Jun. 20, 2019 (KR) 10-2019-0073503

Publication Classification(51) **Int. Cl.***H01Q 5/307* (2006.01)*H03H 7/46* (2006.01)

A frontend module includes an antenna terminal, and a duplexer including a first filter connected to the antenna terminal and a first terminal, configured to perform cellular communications within a 3.3 GHz to 4.2 GHz band, and a second filter connected to the antenna terminal and a second terminal, configured to perform Wi-Fi communications within a 5.15 GHz to 5.950 GHz band, wherein each of the first filter and the second filter includes an LC filter, and a portion of an operating time period of the first filter overlaps a portion of an operating time period of the second filter.

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US 20200321702A1

(19) **United States**(12) **Patent Application Publication****LEE et al.**(10) **Pub. No.: US 2020/0321702 A1**(43) **Pub. Date:****Oct. 8, 2020**(54) **PLANAR MULTIPOLE ANTENNA****Publication Classification**

(71) Applicant: **CHUNG ANG UNIVERSITY
INDUSTRY ACADEMIC
COOPERATION FOUNDATION,**
Seoul (KR)

(51) **Int. Cl.**
H01Q 9/28 (2006.01)
H01Q 21/06 (2006.01)
H01Q 1/48 (2006.01)
H01Q 25/00 (2006.01)

(72) Inventors: **Han Lim LEE**, Seoul (KR); **Ye Bon KIM**, Seoul (KR); **Hyun Jun DONG**, Seongnam-si (KR); **Young-Jun Kim**, Suwon-si (KR)

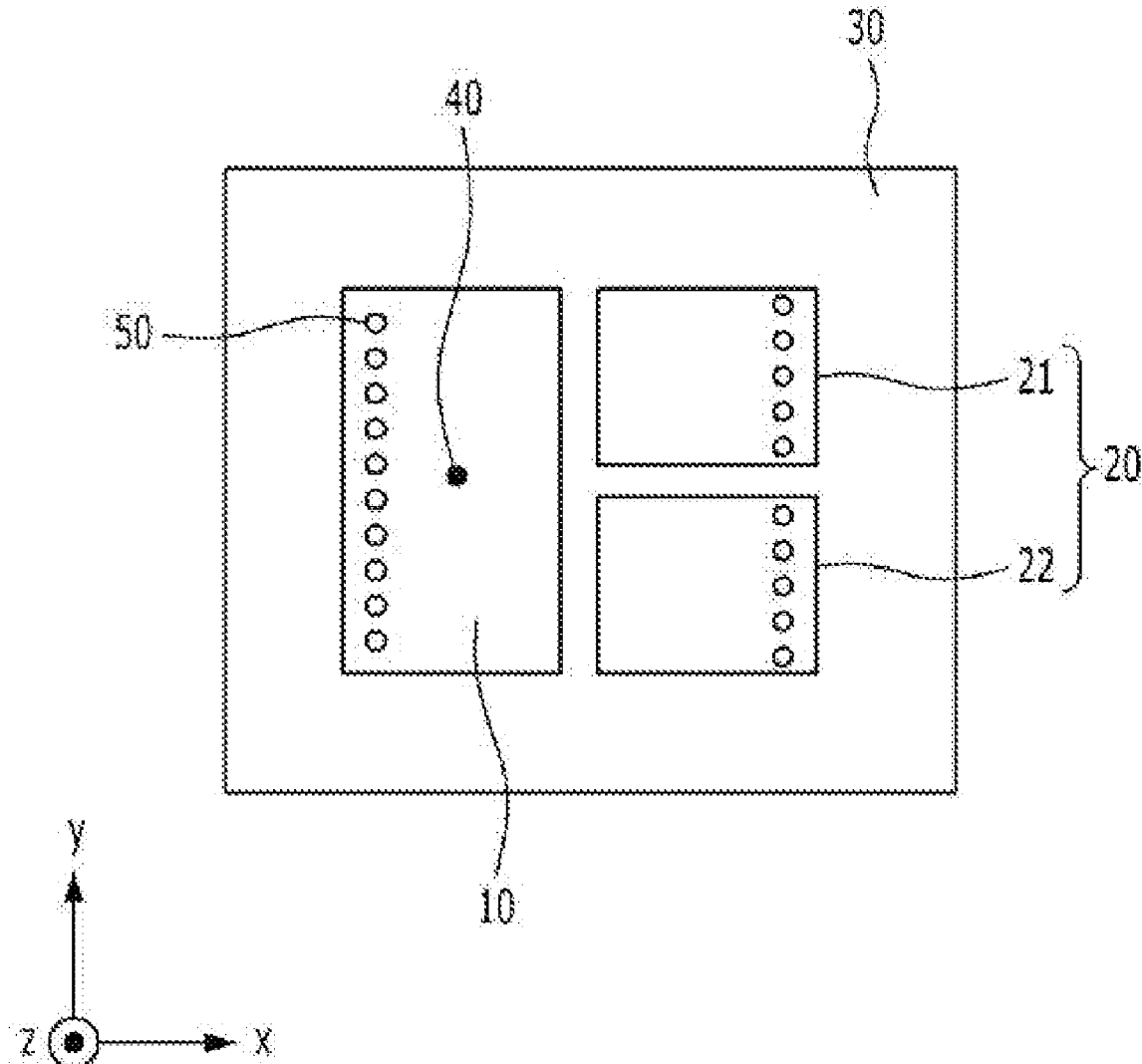
(52) **U.S. Cl.**
CPC *H01Q 9/285* (2013.01); *H01Q 25/002* (2013.01); *H01Q 1/48* (2013.01); *H01Q 21/062* (2013.01)

(57) **ABSTRACT**

Provided is a planar multipole antenna, and more particularly, to a planar multipole antenna which is capable of adjusting a beam width and a band characteristic and reducing the size. The planar multipole antenna includes a plurality of radiators formed above a conductor plate, the plurality of radiator includes a main radiator and a plurality of additional radiators, the main radiator includes a signal applying hole to which a signal is applied, and the additional radiator is connected to a ground formed on the conductor plate.

(21) Appl. No.: **16/839,572**(22) Filed: **Apr. 3, 2020**(30) **Foreign Application Priority Data**

Apr. 3, 2019 (KR) 10-2019-0039026





US 20200321713A1

(19) **United States**(12) **Patent Application Publication**
Khripkov et al.(10) **Pub. No.: US 2020/0321713 A1**(43) **Pub. Date: Oct. 8, 2020**(54) **MIMO ANTENNA MODULE**(71) Applicant: **HUAWEI TECHNOLOGIES CO., LTD.**, Shenzhen, Guangdong (CN)(72) Inventors: **Alexander Khripkov**, Helsinki (FI);
Zlatoljub Milosavljevic, Helsinki (FI)(73) Assignee: **HUAWEI TECHNOLOGIES CO., LTD.**, Shenzhen, Guangdong (CN)(21) Appl. No.: **16/496,739**(22) PCT Filed: **Mar. 24, 2017**(86) PCT No.: **PCT/EP2017/057045**

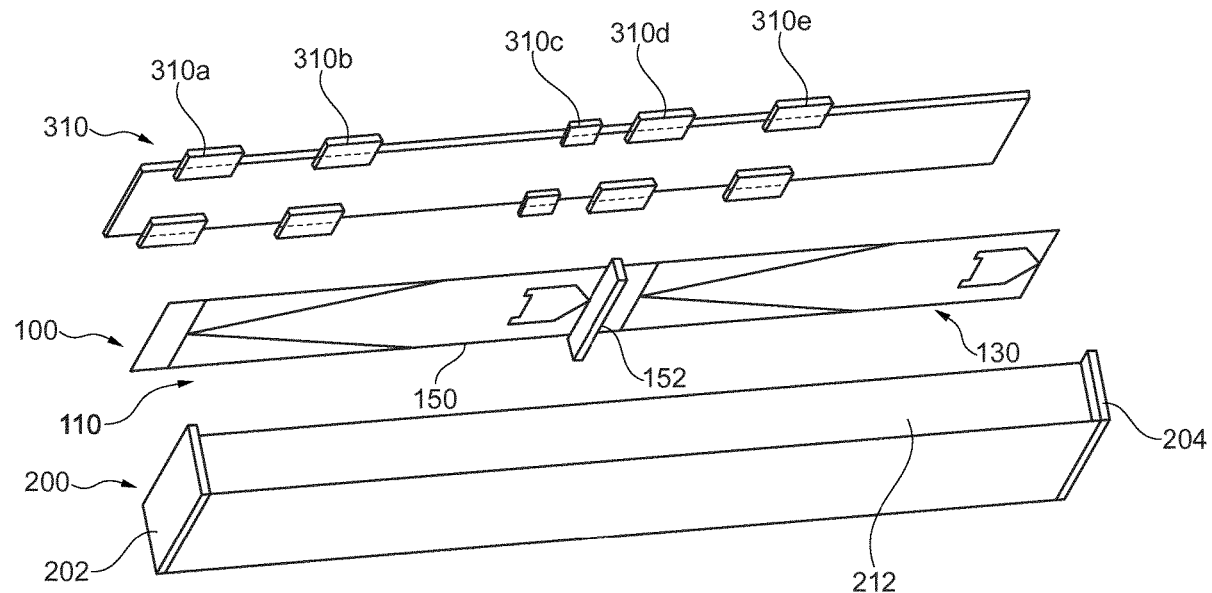
§ 371 (c)(1),

(2) Date: **Sep. 23, 2019****Publication Classification**(51) **Int. Cl.****H01Q 21/28** (2006.01)**H01Q 21/30** (2006.01)**H01Q 1/38** (2006.01)**H01Q 13/10** (2006.01)**H01Q 13/18** (2006.01)**H01Q 9/40** (2006.01)**H04B 7/0413** (2006.01)(52) **U.S. Cl.**CPC **H01Q 21/28** (2013.01); **H01Q 21/30**(2013.01); **H01Q 1/38** (2013.01); **H04B****7/0413** (2013.01); **H01Q 13/18** (2013.01);**H01Q 9/40** (2013.01); **H01Q 13/106** (2013.01)

(57)

ABSTRACT

A multiple input-multiple output (MIMO) antenna assembly for an antenna module includes a planar dielectric member and at least one MIMO antenna formed on a surface of the planar dielectric member. The at least one MIMO antenna includes a slot antenna formed as a first conductive pattern on a surface of the planar dielectric member and a monopole antenna. The monopole antenna is formed as a second conductive pattern on the surface of the planar dielectric member and is disposed in a slot portion of the slot antenna.





US 20200321988A1

(19) **United States**(12) **Patent Application Publication** (10) **Pub. No.: US 2020/0321988 A1**
(43) **Pub. Date:** **Oct. 8, 2020**(54) **ELECTRONIC DEVICE COMPRISING
ANTENNA AND METHOD FOR
TRANSMITTING OR RECEIVING SIGNAL**(71) Applicant: **Samsung Electronics Co., Ltd.**,
Gyeonggi-do (KR)(72) Inventors: **Yongyoun KIM**, Gyeonggi-do (KR);
Hyoseok NA, Gyeonggi-do (KR);
Kyoungho KIM, Gyeonggi-do (KR);
Jungsik PARK, Gyeonggi-do (KR);
Sunghyup LEE, Gyeonggi-do (KR)(21) Appl. No.: **16/766,975**(22) PCT Filed: **Jan. 21, 2019**(86) PCT No.: **PCT/KR2019/000834**

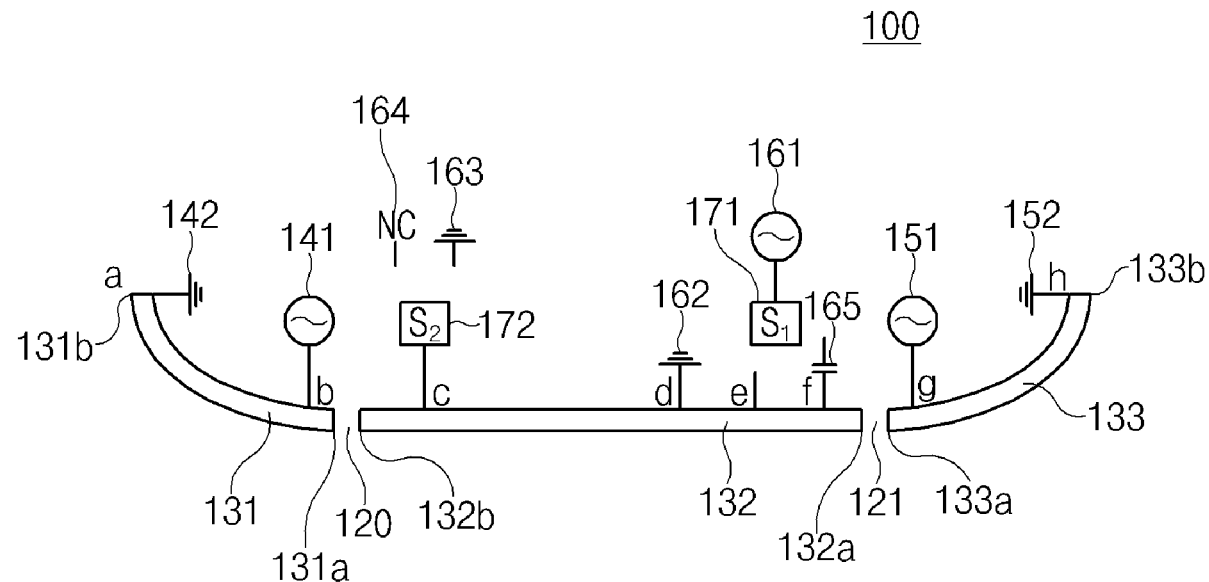
§ 371 (c)(1),

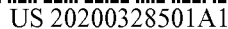
(2) Date: **May 26, 2020**(30) **Foreign Application Priority Data**

Jan. 22, 2018 (KR) 10-2018-0007778

Publication Classification(51) **Int. Cl.****H04B 1/00** (2006.01)**H05K 5/02** (2006.01)**H01Q 1/24** (2006.01)**H01Q 1/48** (2006.01)**H04B 1/40** (2006.01)(52) **U.S. Cl.**CPC **H04B 1/0064** (2013.01); **H05K 5/0217**
(2013.01); **H04B 1/40** (2013.01); **H01Q 1/48**
(2013.01); **H01Q 1/24** (2013.01)(57) **ABSTRACT**

Disclosed is an electronic device which includes a housing that includes a first plate, a second plate facing away from the first plate, and a side member surrounding a space between the first plate and the second plate, wherein the side member includes a first conductive portion including a first end and being elongated, a second conductive portion including a second end and a third end and being elongated, the second end being adjacent to the first end, a third conductive portion including a fourth end adjacent to the third end and being elongated, a first insulating portion disposed between the first end and the second end to contact the first end and the second end, and a second insulating portion disposed between the third end and the fourth end to contact the third end and the fourth end, a display that is exposed through the first plate, at least one wireless communication circuit that is electrically connected with a first point placed at the first conductive portion and adjacent to the first end, a first switching element electrically connected with a second point, which is placed at the second conductive portion and is adjacent to the third end, through a capacitive element and electrically connected with a third point placed at the second conductive portion and adjacent to the third end, and a fourth point placed at the third conductive portion and adjacent to the fourth end, at least one ground member that is electrically connected with a fifth point placed at the first conductive portion and more distant from the first end than the first point, a second switching element electrically connected with a sixth point placed at the second conductive portion and adjacent to the second end, a seventh point placed at the second conductive portion and adjacent to the third point, and an eighth point placed at the third conductive portion and more distant from the fourth end than the fourth point, and a control circuit that is configured to control the first switching element and the second switching element. Moreover, various embodiment found through the present disclosure are possible.





(12) **Patent Application Publication**
KANG et al.

(43) **Pub. Date:** **Oct. 15, 2020**

(2006.01)

(2006.01)

(2006.01)

(2006.01)

(2006.01)

(52) U.S. Cl.

CPC *H01Q 1/243* (2013.01); *H01Q 5/328*
(2015.01); *H01Q 5/335* (2015.01); *H04B 1/38*
(2013.01); *H01Q 9/30* (2013.01); *H01Q 9/045*
(2013.01); *H04M 1/026* (2013.01)

(57)

ABSTRACT

(22) PCT Filed: **Jun. 24, 2016**

§ 371 (c)(1).

(2) Date: **Nov. 29, 2018**

(30) **Foreign Application Priority Data**

Jun. 1, 2016 (KR) 10-2016-0068186

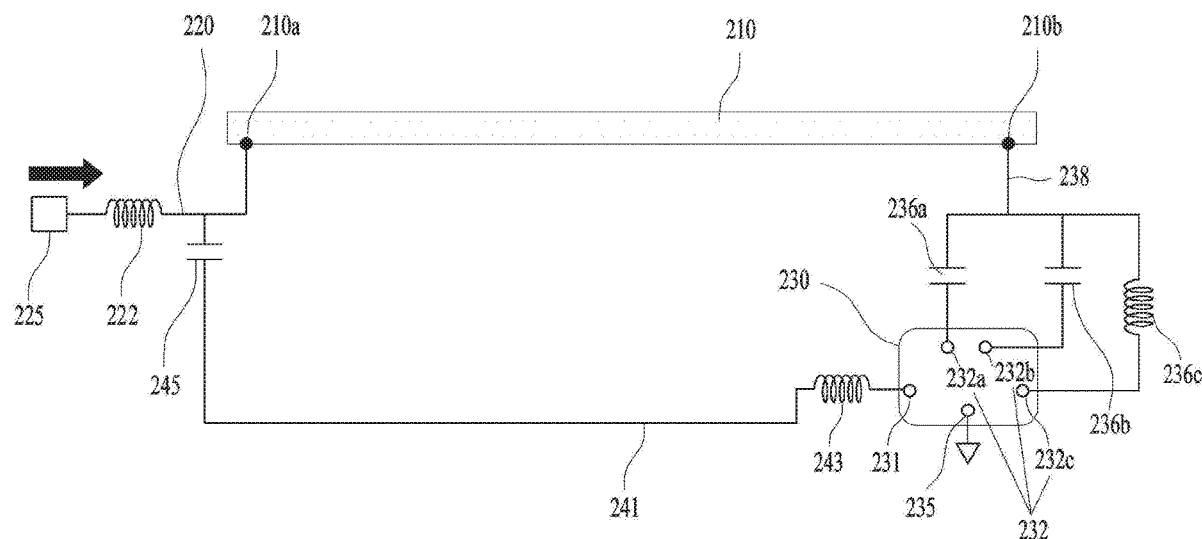
Publication Classification

(51) **Int. Cl.**

H01Q 1/24 (2006.01)

H01Q 5/328 (2006.01)

Provided is a mobile terminal comprising: a case; an antenna radiator mounted in the case; a ground mounted in the case; an radio frequency (RF) signal supply unit for generating a Radio Frequency (RF) signal; a feeding line connecting the RF signal supply unit and a first point of the antenna radiator so as to supply the RF signal; a switch having one end apart from the feeding line and selectively connecting one of a plurality of ports to the ground; a capacitor connected in parallel to the feeding line; a transmission line connecting the capacitor and a first port of the switch; and a first switch line connecting a second port of the switch and a second point of the antenna radiator, whereby the mounting area and the number of the switches can be reduced, and thus the manufacturing cost can be decreased and space efficiency can be improved.





US 20200328502A1

(19) **United States**(12) **Patent Application Publication****Tai et al.**(10) **Pub. No.: US 2020/0328502 A1**(43) **Pub. Date: Oct. 15, 2020**

(54) **ANTENNA INCLUDING CARRIER FORMED USING A COMPOSITE PLASTIC MATERIAL HAVING A DIELECTRIC CONSTANT WITHIN A SPECIFIC RANGE**

(71) Applicant: **Amphenol Taiwan Corporation**,
Taoyuan City (TW)

(72) Inventors: **Shu-Te Tai**, Taoyuan City (TW); **Chee Ming Eea**, Taoyuan City (TW);
Yu-Hsun Huang, Taoyuan City (TW);
Feng-Pin Chang, Kaohsiung City (TW)

(21) Appl. No.: **16/653,925**

(22) Filed: **Oct. 15, 2019**

(30) **Foreign Application Priority Data**

Apr. 12, 2019 (TW) 108112798
Jul. 17, 2019 (TW) 108125303

Publication Classification

(51) **Int. Cl.**
H01Q 1/24 (2006.01)
H01Q 1/38 (2006.01)

H01Q 5/30 (2006.01)

H01Q 9/30 (2006.01)

H01Q 9/04 (2006.01)

H01Q 7/00 (2006.01)

H01Q 13/10 (2006.01)

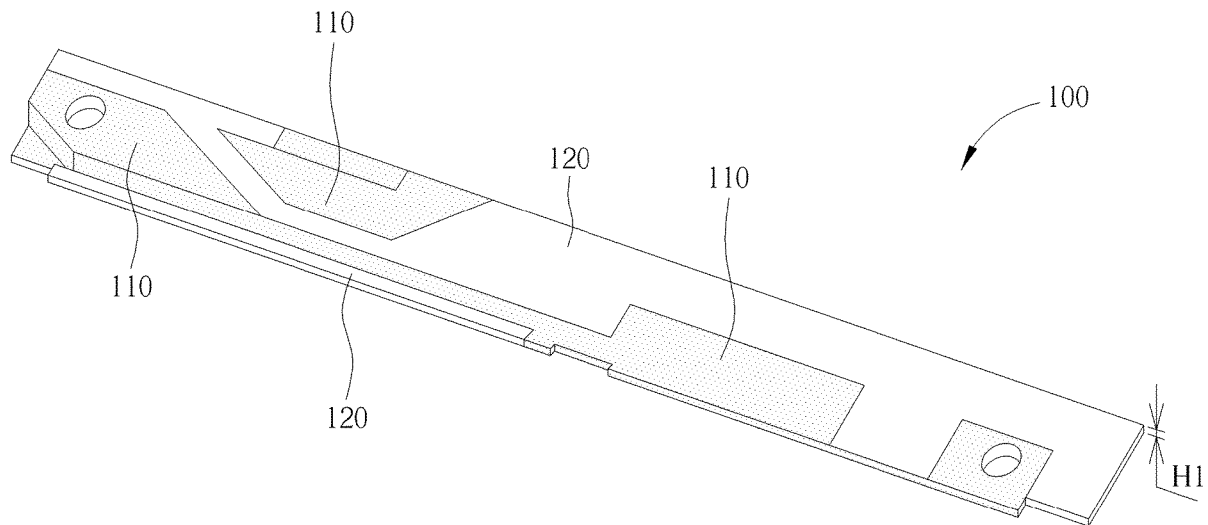
(52) **U.S. Cl.**

CPC **H01Q 1/243** (2013.01); **H01Q 1/38**
(2013.01); **H01Q 5/30** (2015.01); **H01Q 13/10**
(2013.01); **H01Q 9/0421** (2013.01); **H01Q**
7/00 (2013.01); **H01Q 9/30** (2013.01)

(57)

ABSTRACT

An antenna includes a carrier and at least one conductive component. The carrier may be formed using a composite plastic material. The carrier may provide at least one containing area. The composite plastic material may have a dielectric constant. The at least one conductive component may be formed at the at least one containing area to be combined with the carrier. The at least one conductive component may form a pattern. The dielectric constant may be between a first value and a second value where the first value and the second value are larger than zero, and the first value is smaller than the second value. The first value is substantially six.





(19) **United States**

(12) **Patent Application Publication**
DENG

(10) Pub. No.: US 2020/0328520 A1

(43) **Pub. Date:** **Oct. 15, 2020**

(54) **ANTENNA AND ELECTRONIC DEVICE**

(52) U.S. Cl.

CPC **H01Q 9/0457** (2013.01); **H05K 1/0243**
(2013.01); **H01Q 5/335** (2015.01)

(71) Applicant: **HUAWEI TECHNOLOGIES CO., LTD.**, Shenzhen, Guangdong (CN)

(72) Inventor: **Shaogang DENG**, Shenzhen (CN)

(57)

ABSTRACT

(21) Appl. No.: **16/305,665**

(22) PCT Filed: **May 31, 2016**

(86) PCT No.: **PCT/CN2016/084177**

§ 371 (c)(1),

(2) Date: **Nov. 29, 2018**

Publication Classification

(51) **Int. Cl.**

H01Q 9/04 (2006.01)

H01Q 5/335 (2006.01)

H05K 1/02 (2006.01)

The present disclosure provides an antenna. The antenna includes a PCB board, a matching circuit, and a feeder. The PCB board is provided with a ground plane. The ground plane is provided with an open slot. One end of the matching circuit is connected to a signal source, and the other end of the matching circuit is connected to an end of the feeder. The feeder passes across the open slot. An endpoint of the feeder is connected to one side of the open slot. The antenna further includes a capacitor C1 and an inductor L1. The capacitor C1 and the inductor L1 are located in the open slot. The capacitor C1 and the inductor L1 are connected in series. The antenna may further generate a low frequency based on an original frequency band.

